

CLAIMS

1. A quality evaluation apparatus for fruits and vegetables comprising a light emitting section (1) for emitting light to fruits or vegetables acting as measured objects (M) placed in a position for measurement, a light receiving section (2) for receiving transmitted light or reflected light from the measured objects (M) at a photo-detective sensor (23) of charge storage type to obtain photo-detective information for quality evaluation, a transporting device for transporting the measured objects (M) via the position for measurement, and a control device for obtaining inner quality information of the measured objects (M) based on the photo-detective information from the light receiving section (2) and for controlling operation of the respective sections,
 - wherein the control device repeatedly executes a charge storage discharge process for allowing the photo-detective sensor (23) to store charges until a predetermined charge storage time elapses from start of charge storage and then releasing the charges stored in the photo-detective sensor (23) until lapse of a predetermined discharge time when a measured object (M) is not present in the position for measurement or when the photo-detective information for quality evaluation has already been obtained even if a measured object (M) is present in the position for measurement, and
 - wherein the control device allows the photo-detective sensor (23) to release the charges stored therein until the predetermined discharge time elapses when a measured object (M) transported by the transporting device reaches the position for measurement, and then executes a measurement charge storage process for storing charges in the photo-detective sensor (23) to be used as the photo-detective information for quality evaluation until lapse of a predetermined

measurement time.

2. A quality evaluation apparatus for fruits and vegetables as claimed in claim 1 further comprising an incidence switching device (17) switchable between an open state for allowing the transmitted light or reflected light from the measured objects (M) to be received at the photo-detective sensor (23), and a closed state for preventing the light from being received at the photo-detective sensor,

wherein the control device controls operation of the incidence switching device (17) to switch from the closed state to the open state when a measured object (M) reaches the position for measurement, and to reinstate the closed state after the open state is maintained until lapse of the predetermined measurement time.

3. A quality evaluation apparatus for fruits and vegetables as claimed in claim 1 or 2, wherein the transporting device transports the measured objects (M) as placed in particular positions on saucers (71), and

wherein the control device includes a saucer detecting device (73) for detecting that a forward end in a transporting direction of a saucer (71) has reached a predetermined position, thereby to determine that a measured object (M) has reached the position for measurement based on detection information from the saucer detecting device (73).

4. A quality evaluation apparatus for fruits and vegetables as claimed in claim 1 or 2, wherein the control device includes an object detecting member (50) for detecting that a forward end in a transporting direction of a measured object (M) transported by the transporting device has reached a position upstream of the position for measurement in the transporting direction, and a transporting distance measuring

device (19) for measuring a transporting distance of the measured objects (M) transported by the transporting device, and

wherein the control device determines that a measured object (M) has reached the position for measurement based on detection information from the transporting distance measuring device (19) after detecting that the forward end of the measured object (M) has reached the upstream position based on detection information from the object detecting device (50).

5. A quality evaluation apparatus for fruits and vegetables comprising:

a light emitting section (1) for emitting near-infrared light to measured objects (M) placed in a position for measurement;

a light receiving section (2) for separating the light transmitted through or reflected from the measured objects (M) into rays and receiving the separated rays at a plurality of unit photodetectors (23a); and

a computing section (100) for executing a quality evaluation process to obtain quality evaluation values of fruits or vegetables based on photo-detective information from the light receiving section (2) obtained when the fruits or vegetables as the measured objects (M) are measured and on a calibration formula established in advance for quality evaluation of the fruits and vegetables;

the computing section (100) being switchable to a state for executing a wavelength calibration process, instead of the quality evaluation process, to determine wavelengths received by the plurality of unit photodetectors (23a), respectively, based on photo-detective information from the light receiving section (2) obtained when a reference object for wavelength calibration is measured as the measured object (M) which has characteristics in light transmission with respect

to the near-infrared light of a specific wavelength;

wherein the calibration formula is established by using the photo-detective information with a resolution greater than a maximum resolution of the photo-detective information determined by the number of the plurality of unit photodetectors (23a); and

wherein the computing section (100) executes the wavelength calibration process by using the photo-detective information with a resolution smaller than the resolution with which the calibration formula is established.

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6. A quality evaluation apparatus for fruits and vegetables as claimed in claim 5, wherein the computing section (100) executes the wavelength calibration process with the maximum resolution of the photo-detective information.

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7. A quality evaluation apparatus for fruits and vegetables as claimed in claim 5, wherein the reference object (84) for wavelength calibration has two or more specific wavelengths as the specific wavelength, and

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wherein the computing section (100) determines a plurality of unit photodetectors (23a) receiving the plurality of specific wavelengths among the plurality of unit photodetectors (23a) in the wavelength calibration process, thereby to obtain the wavelengths received by the other unit photodetectors (23a) based on position information of the particular unit photodetectors (23a) with respect to all the unit photodetectors (23a) and the specific wavelengths.

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8. A quality evaluation apparatus for fruits and vegetables as claimed in claim 5, wherein the light receiving section (2) receives light of a predetermined wavelength band including the specific wavelengths

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at 1024 unit photodetectors (23a), and

wherein the computing section (100) determines the wavelengths of the separated rays with a wavelength resolution of 0.8 nanometers or less in executing the wavelength calibration process, and
5 determines the wavelengths of the separated rays with a wavelength resolution of 2 nanometers or more to obtain the quality evaluation values of the measured objects (M) in establishing the calibration formula.

10 9. A quality evaluation apparatus for fruits and vegetables as claimed in claim 5 further comprising a light amount adjusting device (E) for varying and adjusting a light amount of light received by the light receiving section (2) in the transmitted light or reflected light from the measured object (M).

15 10. A quality evaluation apparatus for fruits and vegetables as claimed in claim 5 further comprising a horizontal position adjusting device (30) for varying and adjusting a light emitting position of the light emitting section (1) and a light receiving position of the light
20 receiving section (2) relative to the position for measurement, respectively, along a direction in which these positions move toward or away from each other.

25 11. A quality evaluation apparatus for fruits and vegetables as claimed in claim 5 further comprising an incidence switching device (17) switchable between an open state for allowing the transmitted light or reflected light from the measured objects (M) to be received at the unit photodetectors (23a), and a closed state for preventing the transmitted light or reflected light from the measured objects (M) from being
30 received at the unit photodetectors (23a); and

an operation control device (101) for controlling operation of the respective sections;

5 wherein the operation control device (101) controls operation of the incidence switching device (17) to switch from the closed state to the open state when the measured objects (M) are placed in the position for measurement, and to reinstate the close state after the open state is maintained until lapse of an open state maintaining time, and controls operation of the light receiving section (2) to execute a measurement process for receiving the light from the measured objects (M) at the unit
10 photodetectors (23a) while the incidence switching device (17) is maintained in the open state.

12. A quality evaluation apparatus for fruits and vegetables as claimed in claim 5 further comprising a transporting device for
15 transporting the measured objects (M) via the position for measurement.

13. A quality evaluation apparatus for fruits and vegetables as claimed in claim 12 further comprising a shading member (90) for
20 blocking stray light entering the unit photodetectors (23a) without being transmitted through the measured objects (M), in the light emitted from the light emitting section (1), while allowing the measured objects (M) transported by the transporting device to pass through the position for measurement.

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